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SOUTH DAKOTA
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Research

A REPORT OF PROGRESS

Vol. V SUMMER, 1954 No. 4

In This Issue

The Cover

It was just about a year ago that we stopped to chat a minute at the farm of Leopold Reather, east of Brookings on Highway 14. He was very busy threshing oats that day, but took time to tell us that this 320-acres was the largest of his farms.

Goodby

Someone else will be saying hello to you in the next issue of our *Farm and Home Research*. Before I leave for my new job in Michigan, I want to thank you all for your many encouraging and friendly letters about the Quarterly. I also want to thank those who sent in pictures. Several of you were especially obliging in allowing us to take pictures of you and your farms to illustrate some article in the Quarterly. Thank you again—and goodbye.

The Editor

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SOUTH DAKOTA FARM AND HOME RESEARCH will be sent free to any resident of South Dakota in response to a written request to the editor, Agricultural Experiment Station, South Dakota State College, Brookings, S. D.

Dear Folks:

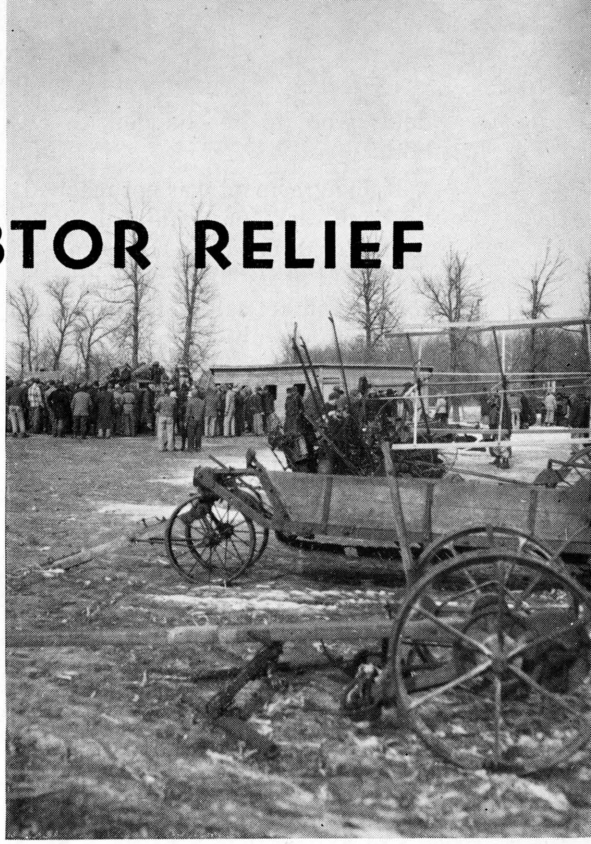
At the time of this writing our small grains are off to a good start because of the general favorable moisture conditions in most areas of the state. Our livestock came through our mild winter in good condition. When we compare our present status with that being experienced in several other states we are indeed very fortunate.

Much is being said about agricultural surpluses, restricted acreages, and diverting more and more acres to grasses and legumes. More basic information is needed on related problems, such as net income, effective management and utilization of forages and efficiency in production in order to attain these current objectives. Research is the only frontier that will help solve these problems and point the way to more efficient, sustained and permanent agriculture. Several articles in this issue report some recent research findings on more efficient utilization and production of crops grown and developed for this state.

Cordially,

W. W. WORZELLA
Acting Director

Talking Over FARMER-DEBTOR RELIEF *Legislation*



By Ernest Feder and J. A. Munger

To talk about farm distress now when agriculture has just gone through a decade of nearly uninterrupted prosperity is good policy. It is widely recognized that the best time to set up permanent measures to prevent mass foreclosures and bankruptcies is when we have leisure to work out effective, well-balanced measures. Congress has lately considered several bills to give individual farmers relief when in financial distress. These bills are all in the form of a new chapter to the U. S. Bankruptcy Laws and are entitled: *Chapter XVI: Farmer-Debtor Relief.*

The Frazier Lemke Act

Section 75 of the U. S. Bankruptcy Laws (the "Frazier Lemke Act") was passed in 1933 during the depth of the depression, amended in 1935 and renewed by Congress from time to time. This Act expired in 1949 and the question is being discussed as to the type of measure that should be passed by Congress to replace it. Its purpose was to "effectuate a broad program of rehabilitation of distressed farmers faced with disaster of forced sales and oppressive burden of debt."

The need for federal legislation was urgent, even in retrospect: foreclosures and bankruptcies were very numerous. Considerable unrest existed in many farm communities. For instance, in March 1933, a group of farmers marched to Aberdeen to prevent the local sheriff from foreclosing farms; creditors were afraid to hold public auction, and petitioned for private auction sales.

Section 75 provided for two methods of relief through an altered bankruptcy procedure: it enabled a farmer to ask his creditors for a compromise agreement under supervision of the court: for an "extension" of time for paying his debts; for a "composition" if the amounts of the

debts were to be changed, or for both.

If an agreement was not reached, he could ask for a judicial moratorium of three years. His farm was appraised at its "then fair and reasonable market value." He remained on the farm subject to rental payments. All proceedings against him were stayed with all "existing mortgages, liens, pledges or encumberances (remaining) in full force and effect."

After, or during, the three years, the farmer could offer to pay the amount of the appraisal—or reappraisal—less payment on the principal. This "redemption," of course, was possible only where the farmer found a lender willing to loan the necessary funds. Upon payment of this amount, the farmer became owner of the farm, free of his old debts. However, a public auction could be requested by a secured creditor in which case the farmer had 90 days to buy back the farm; or the court would order the sale if the farmer was unable to refinance himself.

The Act has been the object of much discussion. It was hurriedly written. It took several years before the courts clarified and interpreted its provisions, but its legality was firmly established after several Supreme Court tests.

The actual operation of the Act and its effect on agriculture have, however, never been fully appraised. It is known that many lower courts, attorneys, and credit institutions were hostile to it, partly because of its new, then still unorthodox procedure; partly because it deprived creditors of the traditional method of enforcing their claims and forced them into a procedure, at the will of the debtor, resulting possibly in a financial loss to them which in some instances they believed, rightly or wrongly, they could have avoided. Nor is it easy to appraise the effects of the Act: in addition to its actual operation, its mere existence might have indirectly encouraged a creditor to agree to an arrangement with the farmer, in order to avoid the use of the Act.

Recent Congressional Bills

There are now two types of bills in Congress. One is similar in purpose and method to the expired Act; the other appears to be basically different.

The first bill, passed by the Senate three years ago, but not by the House, and still subject to consideration by Congress, is detailed and complicated. It follows broadly the former Act except that the moratorium is granted immediately after the farmer petitions for relief (See Table 1, Column 2). It is a *debt adjustment bill*, providing for possible "scale down" or adjustment of debts. But while it is apparently a bill for distressed farmers, it is written in unclear, cumbersome language so that farmers, agricultural economists, or extension workers can hardly understand its meaning—a serious and unnecessary shortcoming.

The other bill which was passed by the Senate both in 1952 and 1953 (but has not yet reached the House) is in the nature of a *federal moratorium bill*. It apparently deviates from former types of federal bank-

ruptcy legislation. It does not provide in principle for a debt adjustment, but only for a judicial moratorium. It follows a relatively simple procedure (Table 1, Column 3). Since there is no debt adjustment, there is no appraisal of the farm and no "redemption." At the end of the moratorium, the financial structure of the farmer, *i.e.* the amount of his original, secured debts, is basically unchanged. However, unsecured debts may apparently be scaled down.

While the inclusion of an "unlimited" moratorium appears to be a desirable measure, on closer examination the bill contains provisions which may cast doubt on its adequacy. For example, the law does not require an appraisal of the farm, but in making an offer for rental payments the farmer must base his offer on the market value of the property. It is difficult to see how this can be done without making an appraisal. Or: if a farmer defaults in his rental payments, the court may end the proceedings if he does not pay up within two months (apparently a harsh provision and in contradiction to the purpose of the bill).

The bill's own language contradicts its declared purpose: its sponsors specifically stated that the bill is not intended to cover a "nationwide emergency." However, in one

Fig. 1. Number of non-farm bankruptcies and farm bankrupticies (regular and s.75 cases) 1928-52. The number of cases is based on number of petitions to Federal court.

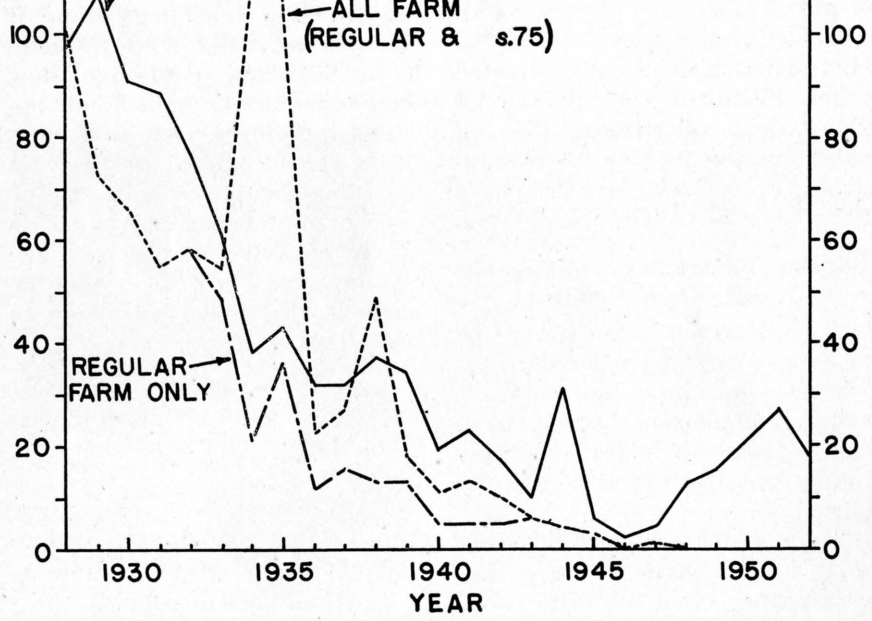


Table 1. Outline of Major Steps in Proceedings

Frazier Lemke Law	Debt Adjustment Bill	Moratorium Bill
Petition for composition or extension. Owners and tenants, though tenants not mentioned.	Petition for relief probably for owners and some tenants. Farmer offers to pay rental.	Petition for relief by owners or tenants.
Appointment of Conciliation Commissioner acting on behalf of court to assist the farmer.	Appointment of referee and possibly trustee. Creditors meeting decides on merit of farmer's case.	Appointment of referee and three resident appraisers. Appraisal of farm at market value.
If proposals for composition or extension accepted by majority of creditors, case dismissed.	If local or national emergency, moratorium granted with no time limit specified. For "unworthy" farmers, no relief.	Moratorium of three years with rental payments as approved by creditors.
If not accepted, section 75(s) can be applied: appraisal of farm and moratorium of three years with rental payments.	Payment of rentals. At two years, or one-year intervals, question of emergency may be raised by creditors in court hearings. Default in rentals must be cleared in 60 days.	During moratorium, debtor may propose extension or composition ("plan") to be accepted by all or majority of creditors and approved by court.
During, or at end of, moratorium, farmer can offer to pay appraisal value and own farm debt free, but prior reappraisal may be ordered. Sale through public auction with redemption, or other method, if farmer cannot refinance himself.	After the end of moratorium farmer may ask for extension of secured debts and composition for unsecured debts. Extension may modify payment plan and interests on secured debts.	As alternative, debtor may attempt redemption of farm at appraised (or reappraised value) through full payment. Or:
	If no extension plan is submitted, case dismissed or farmer goes through regular bankruptcy procedure.	If one-half of (re) appraised value was paid during moratorium, additional two years are granted to pay remainder.

of its provisions, it is stated that a "national emergency" is a cause of a debtor's insolvency beyond his control for which he may be granted relief. Finally, by eliminating all major debt adjustments, the bill side-steps the problem of over-indebted farmers who deserve to have their financial structure readjusted.

Regular Bankruptcy and Frazier Lemke Cases Studied

A good law must be based on one or several well-defined objectives. It must contain provisions which are suited to implement the attainment of these objectives. It should take into account the experiences of the past.

The research for which this summary and preliminary report describes the basic problem area, should be helpful in considering farmer-debtor relief legislation. It attempts first of all to study the heretofore neglected question of how the Frazier Lemke Act actually operated in South Dakota and other Plains states and its adequacy in providing relief; secondly, on the basis of past experience to single out the objectives that such a legislation can hope to achieve, and the methods that are most likely to bring it about.

A preliminary inquiry into farmer bankruptcy cases in the state has brought to light some specific problems.

(1) From 1928 to 1952, there were 792 farm bankruptcies, including *regular* and *section 75 cases*..

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FEED ANALYSES

O. E. Olson, Wm. Kohlmeyer and L. B. Embry

Feed analyses are used for a variety of purposes. One very important use is in the control of feed manufacturing, where certain standards must be met and where uniformity of product should be maintained. State feed regulatory agencies also make analyses to make certain that commercial feeds on the market meet certain specifications as set by law. Another very important user is the research worker, who makes analyses on feeds for numerous purposes. Finally, the feeder, himself, often needs analyses made to assist him in the solution of nutritional or other livestock problems.

Feeds contain many nutrients that can be determined by chemical means, but because each determination is costly and time-consuming, under no circumstance are all analyses made on any single sample. Instead, only those which might be of definite value are made. The feed manufacturer and state regulatory

Laboratory technician weighing out samples for analyses

agencies have laws to guide them in deciding which nutrient the chemist should measure, and research workers have fairly well-established means for selecting what analyses should be made.

In the case of the farmer or rancher, however, there often is no simple set of rules to follow which will assure the wise use of chemical determinations. Instead, each case must be considered by itself. Only by exercising good judgement, based on a knowledge of the meaning and limitations of the many kinds of analyses, and on previous experience with them, can such wise use be assured. It is the purpose of this article to discuss the meaning and value for many types of feed analyses and to point out their limitations.

Meaning and Value of Various Analyses

The term "complete analysis" is often used in connection with feeds. It implies that feeds are analyzed for everything they contain, but such an analysis would be an unending task and is never undertaken. To the chemist the expression "complete analysis" means the same as proximate analysis, which consists of determining the amounts of moisture, crude protein, crude fibre, ether extract, ash and nitrogen-free extract in a feed. The proximate analysis is widely used in experimental, control and regulatory work.

The value of a feed analysis to the livestock producer is that it enables him to meet more accurately the nutritional needs of his livestock than he can by merely using average composition of feed stuffs given in various books on livestock feeding. Feeds vary widely in their content of some nutrients, and average values may have little meaning when applied to one particular lot of feed. However, the need for making a "complete" or proximate analysis for general feeding purposes seldom arises. On the other hand, some parts of this analysis are very helpful on occasion, as discussed below.

Moisture: All feeds contain some moisture. From a nutrient standpoint, it is an unimportant component of the feed. A moisture analysis is usually not necessary when feeding low moisture feeds (feeds that can be stored safely), but since all the feed nutrients are contained in the dry matter, the moisture content is an important consideration when purchasing or feeding high moisture feeds.

Crude Protein: Protein is used by the animal for building muscle tissues, cartilage, connective tissues, skin, hair, wool, feathers, horns and internal organs. It is, therefore, one of the most important constituents of feeds from the standpoint of nutrition. The method used routinely for its analysis measures some non-protein materials as protein. Normally the error caused by this is insignificant from the standpoint of feeding, but in view of it the term "crude protein" is usually used in expressing the results of an analysis.

Considering the several determinations a proximate analysis includes, crude protein is generally the most valuable one. The protein content of many feeds varies widely.

It is usually the most expensive portion of the ration and is often deficient in farm grown grains and roughages. Thus, the greatest outlay of cash for purchased feeds by most livestock feeders will be for protein supplements. When the protein content of the major feeds available on the farm is known, they can often be used in various combinations to meet a large part or all of the protein needs of cattle and sheep. In the case of swine self-fed a protein supplement along with grain, no advantage could be made of a protein analysis on the grain. However, when complete rations are mixed for swine and poultry, protein content of the ingredients going into the mixture is needed in order to know how much protein supplement to add. The crude protein determination tells nothing of the nutritive value of the protein, an important consideration in swine and poultry rations.

The rations of cattle and sheep consist largely of roughages except when they are fed under feed-lot conditions. It is important that these rations contain an adequate amount of protein. The crude protien content of the roughages will vary widely, and it appears to be the best single measure of the nutritive value of these feeds.

Ether Extract: One of the sources of energy in a feed is its fat. The analyst measures this by extracting the sample with ether. This method of removing the fat also removes oils and certain other substances, so the term "fat" when applied to this measurement is not entirely correct. The term "crude fat" is sometimes used instead of ether extract.

The ether extract in feeds is a high energy nutrient. However, most feeds are rather low in their content of this material and a special analysis for it is not often warranted.

Ash: The ash content of a feed is determined by burning off the organic matter and weighing the residue. Ash is composed of minerals, but the results of an ash determination tell little of the nutritive value of this fraction since they do not indicate the amounts of the various minerals present.

Crude Fiber: The chemical method for measuring the fibrous material in feeds is subject to errors, and the term "crude fiber" is therefore used in reference to its analysis. Crude fiber is rather resistant to digestion and has little value for poultry and swine, but cattle and sheep make some use of it. This fraction is carbohydrate in nature, and the animals that do digest it to some extent derive some energy from it. An analysis for crude fiber is seldom of much value to the feeder, since swine and poultry rations are normally composed of low fiber content feeds (grains), the high fiber content feeds (forages) being used for cattle and sheep.

Nitrogen-free Extract: Nitrogen-free extract is often expressed in abbreviated form as NFE. It is composed largely of carbohydrates (sugars and starches and similar substances) and is the major source of energy in feeds. The value for nitrogen-free extract is determined by subtracting the percentages of

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Soil Survey—SPINK COUNTY

Photo courtesy of Roy W. Simonson

Small grain and corn on La Delle silt loam in Spink County

By F. C. WESTIN

A SOIL SURVEY of Spink County has been completed by the Agricultural Experiment Station and the Soil Conservation Service, USDA, and will soon be published. For farmers and others interested in specific tracts of land, this soil survey is meant to answer three main questions: (1) What crops will grow best on my farm? (2) What treatment does my soil need to make it yield its best? and, (3) What yields can I expect?

For readers interested in the area as a whole, this soil survey discusses the location and extent of Spink County, its physiography, relief, drainage, climate, present status of agriculture, organization and population, and transportation facilities. The irrigation potential of each soil mapped in the county is also indicated.

Brief summary of Soil Survey Report

Spink County covers an area of 936,840 acres in east central South Dakota. The topography is nearly level to undulating with only a few rolling areas. Elevations above sea level range from about 1300 to 1400 feet. Drainage is to the south with the principal stream being the James River.

The native vegetation consists of a mixture of short, mid, and tall grasses. In general, the undulating uplands have mixtures of short and mid grasses, while the sandy plain and the alluvial areas are occupied by the tall and mid grasses.

The materials from which the soils have developed include glacial deposits of sand, silt, clay, and gravel; and alluvium (stream deposits).

The soils are classified according to their internal and external characteristics, with emphasis on the features that influence crop production. Productivity of a particular soil depends on a large number of factors which include climate, soil characteristics and management. Of these, management is the only factor that can be controlled. A system of management consists of several practices, which the farmer selects and combines into the system best suited to his farm. Since the soil pattern differs for each farm, it therefore influences the choice of management practices. Crop rotations, maintenance of organic matter in the soil, tillage, the use of commercial fertilizers and erosion control practices are used in a good management system.

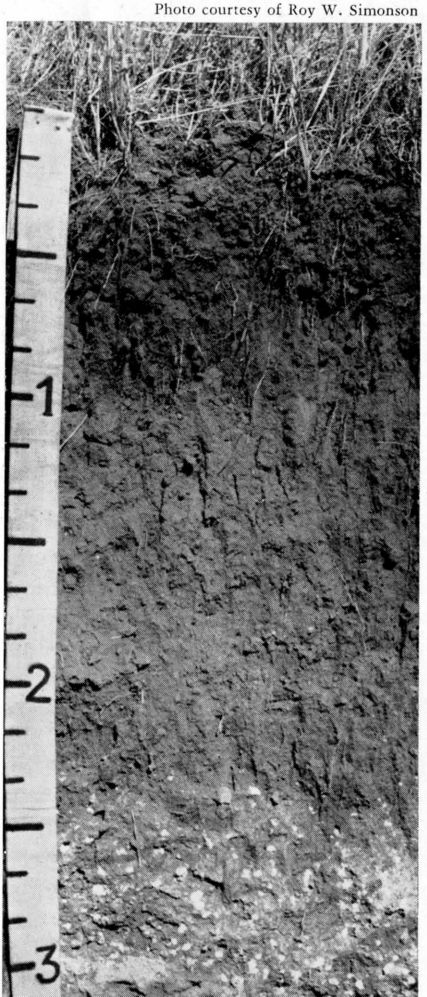
The soil surveyor maps soil differences as they occur naturally out in the field

19 Soil Groups

The soils of the county have been divided into 19 groups on the basis of the factors which affect the use and management of the soil. The principal problems of management for each of the 19 groups of soils are discussed, and estimated yields of wheat, corn, oats, barley, alfalfa and wild hay are given for each soil. (Project 183. Leaders: F. C. Westin, G. J. Buntley, F. E. Shubeck, A. J. Klingelhoets, Agronomy Dept., in cooperation with Soil Conservation Service, USDA.)

Profile of Beadle silt loam, one of the fertile soils in south central Spink Co.

Photo courtesy of Roy W. Simonson



BREED, DIET SEX Affect the *Growth Response* of Chicks to ANTIBIOTICS

By C. W. Carlson

All chicks will not respond alike to antibiotics. Numerous reports have appeared concerning the differences in the antibiotic growth response that were obtained from different types of chickens. In some cases, these variations occurred with different strains of the same breed. It has been found in studies conducted at this station over the past several years that a great number of factors must be involved in this phenomena.

No one can yet adequately explain why the antibiotics produce this effect of improving the rate of growth of chickens, turkeys, and other animals. Chicks or turkeys normally contain literally millions of bacteria, and it would be expected that something which would affect the bacteria might indirectly affect the bird. It is believed that the antibiotics inhibit the growth of undesirable bacteria and promote the growth of desirable bacteria in the digestive tract. The undesirable bacteria would be those that produce toxins that might adversely affect the bird's ability to digest and absorb feed nutrients, thus slowing up the growth rate, whereas the desirable bacteria may actually produce vitamins that the bird can utilize for its own needs. A significant report indicated that chicks which were raised under sterile conditions, or free of bacteria, did not show any growth response to the antibiotics. Other reports have indicated no responses when chicks were reared in new quarters or where exhaustive sanitary measures were taken.

In the studies reported here, all chicks were raised to four weeks of age in electrically heated batteries with raised wire floors. Chicks used during the successive years were from the same strains, but of later generations. Some improved growth rates may have been the result of the selection and mating methods.

Less Growth Response to Antibiotics with Better Diets

The diets used were formulated to be adequate in all known nutrients required for growth. The medium energy diet consisted of a variety of the commonly used ingredients, including animal protein supplements. The corn-soybean diets would be considered the high energy and high efficiency types. Some changes in the original diet used in the summer of 1952 were made in successive seasons, which in part effected an improved rate of growth. Particularly effective was the change made from winter to spring in 1954.

Although the data are not given here, small but consistent growth responses were obtained on the corn-soybean type diets from animal protein supplements or a commercially prepared fermentation material. In general, the growth responses to antibiotics would be expected to be less on such supplemented diets. Wider variations could be expected by using unsupplemented diets, and the data reported in Table 2 are results obtained with their use.

For the most part, procaine penicillin was the sole antibiotic used and at levels of from 2 to 15 grams per ton. Many workers have found that a level of 2 grams per ton is adequate for the maximum growth response. Early work at this station had indicated no beneficial effect from the combination of other antibiotics with penicillin. Since other workers had reported more consistent effects with combinations of antibiotics, the use of terramycin along with penicillin was employed when it appeared that the growth responses were decreasing.

The results of the growth trials are given in Tables 1 and 2. A wide variation in growth responses to the antibiotics is evident. The responses range from a maximum of 49

Table 1. Growth Response to Penicillin Supplementation with Various Types of Chicks on a Medium Energy Diet

Type of Chick	Unsupplemented Growth Weight (4 Weeks)		Increase with Penicillin Supplementation	
	Winter 1951			
	Males	Females	Males	Females
	gm.	gm.	%	%
W. P. Rock	195(22)*	195(31)	49(51)	31(51)
S. C. W. Leghorn	242(13)	236(7)	31(11)	17(9)
N. Hampshire	285(34)	253(25)	18(86)	16(67)
B. P. Rock X R. I. Red	288(8)	256(13)	11(10)	14(13)
Northwester	367(10)	327(16)	9(14)	14(11)

	Spring 1951	
	Mixed Sex	Mixed Sex
	gm.	%
S. C. B. Leghorn	168(21)	9(20)
B. Orpington	198(9)	14(8)
B. Andalusian	205(27)	15(29)
L. Brahma	220(14)	18(14)
D. Cornish	238(39)	25(39)

*Numbers in parentheses refer to the number of surviving chicks.

percent for White Plymouth Rock males on the medium energy diet in the winter of '51 to zero for New Hampshire and Single Cross No. 2 X White Plymouth Rock females on the corn-soybean type diets in the summers of '52 and '53.

It is obvious that all of the facts are not given in these two tables. Different environmental conditions were certainly encountered. The degree of "normal infection" no doubt varied from trial to trial. To have known what types and numbers of bacteria were present in the digestive tracts of the chicks in the various trials might well have allowed for explanation of some of the variations in results. Where there are comparisons available between seasons of the same year and with similar diets, *i.e.* winter and spring of '51 and '54, the general trend indicates a greater response in the winter. This might indicate a greater degree of "normal infection" in the winter, however, such possible variations could not have explained all of the differences encountered.

Response Varies Between Sexes

Where results for both sexes are given, the data represent the average of each sex from a group of straight-run or mixed-sex chicks placed in the pen at the start of the growth trial. Therefore, the two sexes should have been exposed to the same "normal infection." As can be seen from the data, the relative responses shown by males do not correspond in all cases to the relative responses shown by the females. In all cases, the male chicks did respond, whereas in three instances the female chicks—New Hampshires of the summers of '52 and '53 and the single cross No. 2 X White Plymouth Rocks (this single cross contained New Hampshire breeding)—did not respond to the addition of penicillin to the corn-soybean type diets. It is interesting to note that the female White Plymouth Rock X New

Hampshire chicks responded to penicillin supplementation. Further, where terramycin was also added to the corn-soybean diets, the new Hampshire females did respond. It appeared, therefore, that the "normal infection" did not similarly affect the sexes.

That there are breed differences is substantiated by the results obtained in the winter of '51 which indicated that in cases where the unsupplemented growth rate was greater, the growth response obtainable from penicillin was less. However, with the less common breeds in the spring of '51, just the reverse trend was noted. In most other instances where the unsupplemented growth rate was made greater, (either due to the crossing of breeds as in the summer of '53 or to the dietary and possible environmental differences between the winter and spring of '54) the responses to the antibiotics were less.

It would be logical to assume, therefore, that where the growth rate approaches the maximum, supplementation with antibiotics would be less effective. Such things as the use of certain crossbreds or strains selected for a faster growth rate, the use of improved diets, or greater care in management may all contribute to the reduction of growth responses from the antibiotics. However, even under the best of field conditions the antibiotics can be expected to improve significantly the growth rate of chicks. (Project 241. Leaders: C. W. Carlson and R. A. Wilcox, Poultry Dept., O. E. Olson, Station Biochemistry.)

Table 2. Growth Response to Antibiotic Supplementation with Various Types of Chicks on Corn-Soybean Type Diets

Type of Chick	Unsupplemented Growth Weight (4 Weeks)		Increase with Antibiotic Supplementation	
	Males	Females	Males	Females
	gm.	gm.	%	%
Summer 1952—Penicillin—2gm./ton				
W. P. Rock	232(28)*	203(38)	11(36)	10(32)
N. Hampshire	242(17)	231(16)	7(19)	–1(14)
Summer 1953—Penicillin—4 gm./ton				
N. Hampshire	230(13)	235(14)	14(14)	0(14)
B. P. Rock	267(26)	242(17)	5(18)	16(24)
W. P. Rock	273(8)	220(8)	15(8)	19(7)
S. C. No. 1 X W. P. Rock	273(26)	241(22)	5(26)	16(28)
W. P. Rock X N. Hampshire	282(66)	265(58)	11(66)	8(59)
S. C. No. 2 X W. P. Rock	322(29)	309(30)	8(27)	–1(33)
Winter 1954—Penicillin and Terramycin—4 and 10 gm./ton				
N. Hampshire	264(36)	246(41)	14(37)	9(44)
W. P. Rock	279(65)	261(78)	21(65)	14(78)
Exp. Hybrid	288(16)	256(18)	5(19)	8(17)
Spring 1954—Penicillin and Terramycin—12 and 30 gm./ton				
S. C. W. Leghorn	254(42)	.....	7(43)	.....
N. Hampshire	287(43)	250(42)	5(46)	8(36)
W. P. Rock	318(50)	303(50)	11(49)	6(53)

*Numbers in parentheses refer to numbers of surviving chicks.

moisture, protein, ether extract, crude fiber and ash from 100 percent, so its determination obviously involves the analysis for all of these components.

Grains are the chief sources of this high energy nutrient and are not supplemented with other high energy ingredients as they are with high protein ingredients, except for some special type of commercial feeds. When a ration composed largely of roughages does not produce the desired weight gains, grain should probably be substituted for a part of the roughage. An analysis for nitrogen-free extract made on the roughage may be of some assistance in determining the need for such grain supplementation. There are other instances where this analysis may be helpful, but these are not nearly as frequent as where the crude protein analysis is of value.

Minerals

The animal body requires many mineral elements for growth. Some are required in fairly large amounts (principal minerals) while others are required in very small amounts (trace materials). (See *Farm and Home Research,* Volume III, No. 3, page 59, 1952).

Present day feeding practices prescribe the supplementation of rations with calcium, phosphorus and salt, and the remaining principal minerals are generally present in feeds in sufficient quanities. Iodine and cobalt are the only trace minerals that are of concern. The logical and safe way of supplying these two mineral elements is by the use of salt containing iodine and cobalt. For poultry, manganese may be deficient in feeds, and it is commonly added as a supplement to the ration.

The usual practice and recommendation in supplying minerals to livestock is to provide mineral supplements free choice. Such a procedure appears to meet adequately the needs of livestock. When this practice is followed, there is very little need for analyzing for the individual minerals in a feed intended for use in a general feeding program. Analysis of feeds may be needed when nutritional deficiencies are suspected in animals that are fed rations normally considered adequate. In such cases, a livestock nutritionist or veterinarian should be consulted before submitting samples to the laboratory.

Vitamins

Vitamin A: Carotene is the form in which vitamin A occurs in plant materials. The green plant materials are good sources of carotene, and the amount of green color in hays is a good index of carotene content, because chlorphyll and carotene are destroyed at about the same rate in the hay making and storage process. Good quality hays (with green color) and silages stored under proper conditions are excellent sources of carotene, and yellow corn is a fairly good source. Carotene as such has no vitamin A activity, but it is converted to vitamin A in the animal body.

Vitamin A, itself, is often added to mixed feeds. Both carotene and

vitamin A may be destroyed in these mixtures (the form in which they are added and the composition of the feed affects the stability), and after periods of storage the content of either may be markedly reduced. Normally, knowing the types of feed that are being used makes it possible to determine whether sufficient vitamin A or carotene is being supplied. In some cases, however, analysis of the feed is necessary. With hays and grains, or with silages, carotene is determined, while with mixed feeds it may be necessary to determine vitamin A itself. This should be kept in mind in sending samples of mixed feeds for analysis.

Other Vitamins: Except for carotene and vitamin A, feeds are seldom analyzed for vitamin content unless experimental, regulatory or control work is concerned. Most vitamin assays are difficult and expensive. Furthermore, the approximate vitamin contents for most common feedstuffs are known accurately enough to estimate the amounts a ration is supplying with greater accuracy than we now know vitamin requirements.

Poisons and Molds

Poisons and molds in feeds have been discussed in a previous issue of *Farm and Home Research* (Volume V, No. 3, page 56, 1954) and the reader is referred to this discussion for many details in connection with the examination of feeds for the presence of these.

Digestibility of Nutrients

Requests are often received for the analysis of hog, sheep, or cattle feeds for digestible nutrient content. The "complete" or proximate analysis tells nothing of the digestibility of the various nutrients. This must be determined by actual digestion trials of rather long duration with large animals. Obviously, this determination cannot be made routinely. However, values for percent digestibility of protein and other nutrients (digestion coefficients) have been determined for most common feeds and are recorded in several books on nutrition (for example, *Feeds and Feeding* by F. B. Morrison, Morrison Publishing Co., Ithaca, N. Y.). Using these values and knowing the chemical composition of a feed, we can calculate the approximate amount of digestible protein and TDN (total digestible nutrients) in the feed. This calculation can be made at the laboratory when requested, provided the kind of animal being fed is known and provided the digestion coefficient for the particular feed is known. The digestion coefficients are not available for mixed feeds, grain screenings and similar materials that vary considerably in composition.

Sometimes requests are received for determinations of "feeding value" or for the money value of a feed. The term "feeding value" is a rather vague expression, and there is no chemical determination that will measure it nor any quantative way to express it. "Feeding value" includes many factors such as palatability, nutrient and vitamin content, digestibility and others. The proximate analysis may give some indication of "feeding value," but only through feeding trials can it be accurately measured.

Since supply and demand and

many other factors are important in regulating price, it is impossible to calculate accurately the worth of a feed in terms of dollars and cents. Occasionally, however, some help can be obtained in assessing the comparative value of two feeds by protein or other analyses.

Commercial Feeds

Commerically prepared feeds or feed concentrates usually bear a label on which is stated a guaranteed analysis and a list of ingredients. Hence analytical work is unnecessary, except as a regulatory measure. With feed mixtures for which no guaranteed analysis or list of ingredients is given, a limited chemical analysis may be of some value. However, analyses for trace minerals, antibiotics, arsenicals or vitamins (with the possible exception of carotene or vitamin A) are not made on these mixtures at this laboratory because the information obtained from these analyses seldom if ever justifies the cost. As concerns ingredients (percent corn, soybean oil meal screenings, etc.), an accurate analysis is not possible.

Sampling Feeds

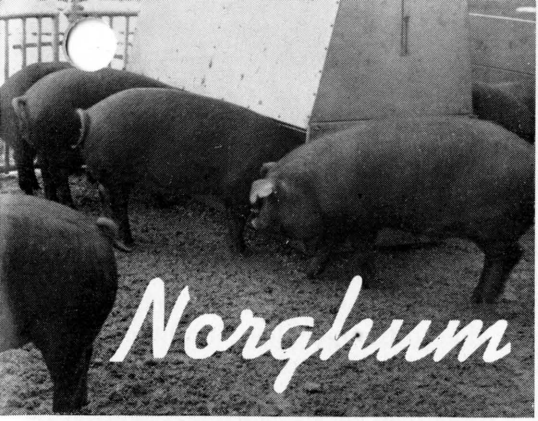
The chemist can analyze only what is sent him, and unless the sample he receives is representative of the entire stack, bin, field, crib or sack, the results he obtains will be of little value. Picking an ear or two of corn from a crib, a handful of hay from a stack, or a handful of feed from the top of a sack is poor sampling procedure. In sampling any feedstuff, every effort should be made to obtain material from a number of points throughout the supply. The material thus obtained may be too large for shipment, so mixing of the combined samples and resampling from this mixture may be necessary.

The amount of sample to collect will depend upon the situation. Generally, only small amounts are necessary for analysis, but in order to insure that a representative sample is obtained, far more is taken than is required by the chemist. When in doubt, send at least two pounds.

Shipment of Samples

Samples should always be carefully wrapped and clearly and properly addressed as follows: Station Biochemistry, College Station, South Dakota. The return address should always be used, since some means of identification of the sample is necessary. Moist samples, such as silage, should be sent in air tight containers to prevent moisture loss. Finally, a letter or post card should be sent describing the sample and explaining what analysis is wanted, or describing in detail why an analysis is requested so that the chemist can decide what should be done.

Questions may arise concerning feed analysis that are not answered here. If the County Agricultural Agent does not have the answer, an inquiry can be directed to this laboratory. Charges are made for most feed analyses, and the county agricultural agent has a list of these charges. (Project 120. Leaders: L. B. Embry, Animal Husbandry; and O. E. Olson, Station Biochemistry).



Sorghum

FOR GROWING-FATTENING PIGS

R. F. Wilson

Numerous inquiries have been received by the Station concerning the feeding value of Norghum. Norghum, an early grain sorghum, adapted to South Dakota growing conditions, was released by the South Dakota Experiment Station in 1949, and has since been grown rather extensively.

To answer these inquiries the Station at Brookings made a comparison of yellow corn with Norghum, both ground and whole, for growing-fattening pigs fed in dry lot. Two trials were conducted; one in the winter of 1949-50 and one in the winter of 1950-51. Experimental work with grain sorghums at other stations indicate that most varieties have a feeding value of approximately 90 percent as much as shelled corn, and nearly all varieties tested to date have been found deficient in carotene (vitamin A).

How the Feeding Trial Was Conducted

Weanling pigs, were allotted in each of the trials on the basis of sex, age, weight and litter to give as nearly as possible, comparable lots of pigs. Pigs of the Duroc, Poland China and Spotted Poland China breeds were used in these trials.

In each trial, three lots of pigs were self-fed, free choice, a grain (corn or Norghum), a protein supplement, and a mineral mixture. In the first trial the protein supplement consisted of 2 parts tankage, 1 part soybean meal and 1 part of dehydrated alfalfa with 1 pound of vitamine A and D added for each 400 pounds of protein supplement. The mineral mixture consisted of 2 parts steamed bonemeal, 2 parts ground limestone and 1 part iodized salt.

In the second trial, the protein supplement consisted of 42 parts tankage, 27 parts soybean meal, 26 parts ground sun-cured alfalfa hay and 5 parts of a complex mineral mixture.

The mineral mixture fed in the second trial was the same as that fed in the first trial except that a trace mineral mixture was added to the iodized salt. This mineral mixture was added to the protein supplement in the second trial as well as self-fed free choice.

Test weights of the grains fed in the first trial were: shelled corn, 53.5

pounds per bushel, and Norghum, 54 pounds per bushel. Test weights of the grains in the second trial were, shelled corn, 53 pounds per bushel, and Norghum, 51 pounds per bushel with 1 percent dockage. It was necessary to clean the Norghum before feeding in the second trial because of weed seeds and trash. Chemical analysis of the grains fed are shown in Table 1.

Pigs Make Good Gains on Whole Norghum

Results of the first trial are given in Table 2 and those of the second trial in Table 3. It will be noted, from Table 2, that the greatest daily gain was made by the pigs that received the Norghum, both ground and whole. Feed consumption per pig was also higher for those fed Norghum, with the largest amount being eaten by those fed the whole sorghum. The feed required per hundred pounds of gain was nearly the same for the three lots. The sorghum-fed pigs consumed slightly more protein supplement per hundred pounds of gain even though the Norghum contained more protein than did shelled corn. On the basis of total feed required per hundred pounds of gain, the ground Norghum had 98.5 percent of the feeding value of the corn, while the whole Norghum had a feeding value of 98.6 percent.

Considerably less feed cost per hundred pounds of gain resulted in the shelled corn lot than in either of the Norghum lots. This, of course, was due to the fact that Norghum cost considerably more per pound than the corn. During the fall and winter of 1949-50, Norghum was rather difficult to obtain; consequently, the price was relatively high.

In the second trial (Table 3) the pigs in all lots made less average daily gains than did the pigs in the first trial. In this trial, the gain made by the whole-Norghum-fed pigs was only slightly greater than that of the corn-fed pigs, while the pigs fed ground Norghum made the least gain. In feed consumed daily per pig, there was a greater consumption of both ground and whole Norghum than shelled corn.

In feed required per hundred pounds of gain, the shelled corn lot was the most efficient, followed by the whole-Norghum lot and lastly by the ground-Norghum lot. Feed costs per hundred pounds of gain were again dependent upon the prices paid for the grains. However, during this fall and winter, sorghum was somewhat of a better

Table 1. Chemical Composition of Grains Fed

	Moisture	Ether Extract (Crude Fat)	Crude Fiber	Crude Protein	Ash (Mineral)	Nitrogen-Free Extract
First Trial (winter 1949-50)						
Shelled yellow corn	14.70	3.90	1.78	9.04	1.32	69.26
Norghum sorghum	12.83	2.91	1.76	11.28	1.55	69.67
Second Trial (winter 1950-51)						
Shelled yellow corn	12.10	4.02	1.83	9.09	1.11	71.85
Norghum sorghum	13.18	3.15	1.71	11.12	1.54	69.30

Table 2. Norghum Sorghum Compared to Shelled Yellow Corn for Growing-Fattening Pigs, 1949-50

Items Compared	Lot I Shelled Yellow Corn	Lot II Ground Norghum Sorghum	Lot III Whole Norghum Sorghum
Number of pigs	10	10	10
Average days on test	103.0	99.0	95.5
Average initial weight, lbs.	55.2	55.8	56.1
Average final weight, lbs.	224.4	224.9	224.4
Average total gain, lbs.	169.2	169.1	168.3
Average daily gain, lbs.	1.64	1.71	1.76
Average daily feed consumed per pig, lbs.			
Grain	5.81	6.11	6.25
Protein supplement	0.70	0.78	0.86
Mineral	0.06	0.06	0.05
Feed	6.57	6.95	7.16
Feed consumed per 100 lbs. of gain, lbs.			
Shelled corn	354.3	.....	.....
Norghum sorghum (ground)	.....	357.5	.....
Norghum sorghum (whole)	.....	.....	354.7
Protein supplement	43.0	45.8	49.1
Mineral mixture	3.7	3.7	2.7
Total	401.0	407.0	406.5
Feed cost per cwt. gain*	$9.15	$12.49	$11.89

*Feed prices used: shelled corn, $1.10 per bu.; Norghum sorghum (whole), $2.65 per cwt.; Norghum sorghum (ground), $2.70 per cwt.; tankage, $5.75 per cwt.; soybean meal, $4.40 per cwt.; dehydrated alfalfa meal, $3.70 per cwt.; vitamin A and D oil, $.25 per pound; ground feeding limestone, $.70 per cwt.; steamed bonemeal, $4.25 per cwt.; iodized salt, $1.55 per cwt.

buy than shelled yellow corn and consequently the whole-Norghum-fed lot had a lower feed cost per hundred pounds of gain than the shelled-corn lot. This was not true of the ground-Norghum lot, however.

These trials indicate that Norghum is quite comparable in feeding value to other grain sorghums. In the first trial, both ground and whole Norghum had, on the basis of total feed required per hundred pounds of gain, an approximate feeding value of 98 percent of that of shelled yellow corn, but in the second trial on the same basis, the whole Norghum had a value of about 91 percent and the ground Norghum, a value of 76 percent.

Tightly Constructed Feeder Needed

Some difficulty was encountered with the feeding of Norghum sorghum, particularly with the whole Norghum. Since the kernels are round and rather smooth, Norghum has a tendency to run down in the feeder and fill the feeding cups. It also has a tendency to run out of the feeder if the feeder is not exceptionally tight. Consequently, whole Norghum must be self-fed in a tightly constructed feeder, otherwise considerable waste may result, especial-

Table 3. Norghum Sorghum Compared to Shelled Yellow Corn for Growing-Fattening Pigs, 1950-51

Items Compared	Lot I Shelled Yellow Corn	Lot II Ground Norghum Sorghum	Lot III Whole Norghum Sorghum
Number of pigs	10	10	10
Average number days on test	128.8	132.8	128.1
Average initial weight, lbs.	43.2	43.1	42.8
Average final weight, lbs.	223.0	221.7	223.3
Average total gain, lbs.	179.8	178.6	180.5
Average daily gain, lbs.	1.40	1.45	1.41
Average daily feed consumed per pig, lbs.			
Grain	4.84	6.44	5.58
Protein supplement	0.60	0.49	0.47
Mineral	0.01	0.01	0.01
Feed	5.45	6.94	6.06
Feed consumed per cwt. of gain, lbs.			
Shelled corn	346.7	----	----
Norghum sorghum (ground)	----	476.8	----
Norghum sorghum (whole)	----	----	396.1
Protein supplement	42.8	36.2	33.2
Mineral mixture	0.8	0.9	0.9
Total feed	390.3	513.9	430.2
Feed cost per cwt. of gain*	$11.03	$12.20	$10.06

*Feed prices used: shelled corn, $1.50 per bu.; Norghum sorghum (whole), $2.20 per cwt.; Norghum sorghum (ground), $2.25 per cwt.; tankage, $5.50 per cwt.; soybean meal, $4.25 per cwt.; alfalfa hay $30.00 per ton; ground feeding limestone, $1.30 per cwt.; bonemeal, $5.25 per cwt.; iodized salt plus trace mineral mixture, $2.20 per cwt.

ly when the feeding is done outside during the winter.

It did not pay to grind the Norghum in either trial, as the pigs fed the whole Norghum made slightly more gain on less feed and at less cost. In the whole-Norghum lot a considerable number of the whole sorghum kernels passed through the pigs without being completely broken down in the digestive process. However, even though this took place, the whole-Norghum lots in both trials required less feed per hundred pounds of gain than the ground-Norghum lots.

Summary

The results of two years' trials comparing ground and whole Norghum sorghum with shelled corn indicate that Norghum sorghum has a feeding value approximately the same as other grain sorghums. The feeding value is about 90 percent that of corn. These trials show that whole sorghum was a more efficient feed than ground sorghum, but that either ground or whole sorghum must be fed from tightly constructed feeders to prevent excessive waste. (Project 85. Leader: R. F. Wilson, former Associate Animal Husbandman, Animal Husbandry Dept.)

This number is slightly below the 942 non-farm bankruptcies. After 1928, the number of farm cases declined, but it rose strongly in 1934 and 1935, and again in 1938, because of the relatively large number of s. 75 cases. Interestingly enough, farmers continued to go through *regular* bankruptcy procedure throughout the thirties and forties (Fig.1) even though s.75 gave them a form of relief not provided for by regular bankruptcy. The reason for this is not yet clear. It has been suggested that regular bankruptcy permits a farmer to make a "clean break with his past," while s.75 would assume that the farmer wishes to continue his farming operation. In many instances, farmers may have been too discouraged to continue to farm. A detailed study may furnish the answer.

(2) The number of *regular* farm bankruptcy cases followed the general pattern of the non-farm bankruptcies, as shown in Fig. 1. This suggests that s.75 did hold a promise for farmers that a regular procedure did not hold. It is noteworthy that the worsening of economic conditions since 1929 was accompanied in South Dakota by a declining trend in the number of bankruptcy cases.

(3) The total number of cases has been largest in some of the best farming counties where farming is relatively diversified and where the effects of the drought may have been less severe than in other parts of the state. The largest number of cases, both regular and s.75 cases, was in the southeastern corner of the state.

(4) The number of s.75 cases was usually higher in those areas where regular cases were high. This suggests that the criticism that farmers took "undue advantage" of the legislation may not be justified. However, there were wide areas in South Dakota in which only a few bankruptcies were recorded during the 25-year period.

(5) Foreclosures seem to reflect more closely the amount of risk in farming than bankruptcies (Table 2). Few counties had less than 200, several had more than 1,000 foreclosures from 1928 to 1949. Foreclosures were heaviest in the western part of the state. Closer analysis

Table 2. Foreclosures (1928-49) and Bankruptcies (1928-53) in South Dakota

Economic Area	Number of Farms in 1950	Foreclosures (1928-49)* Total Number	Foreclosures (1928-49)* Number Per 1000 Farms	Bankruptcies (1928-53) Total Number and (s.75 Cases)		Bankruptcies (1928-53) Number Per 1000 Farms
1	11,047	7,475	680	81	(10)	7.3
2a	7,169	4,208	590	54	(10)	7.5
2b	9,514	5,518	580	166	(87)	17.4
3a	4,869	3,254	670	41	(6)	8.4
3b	10,572	4,384	410	135	(21)	12.8
4a	10,377	4,371	420	90	(20)	8.7
4b	12,783	3,125	240	226	(95)	17.7

*Source: Farm Mortgage Foreclosures in South Dakota 1921—1949, Gabriel Lundy and Ray F. Pengra, Rev. Supplement to Circular 17, Agricultural Economics Department, South Dakota State College, December 1950.

may reveal the peculiar circumstances under which farmers resort to bankruptcy procedures. The small number of s.75 cases in relation to the incidence of foreclosures undoubtedly makes an examination of the adequacy of the legislation in giving relief to distressed farmers necessary.

(6) Of the 249 Frazier Lemke cases in South Dakota, 22 resulted in "discharge;" 227 in "dismissal." Under the Act, a discharge was granted by the Court after completion of the redemption procedure. Apparently only a small proportion of farmers thus actually redeemed their farm as provided for by the Act. The reasons for the frequent "dismissals" are not yet clear. A dismissal could be ordered under the law, for example, if a farmer had reached an agreement with his creditors; or if he did not apply for confirmation of an extension or composition agreement. A failure to apply does not necessarily indicate that the Act failed to produce the desired effect, since a settlement with the creditors can always be reached outside of court.

Sometimes the fact that foreclosure procedures had already been completed before the farmer applied for relief; or the apparent lack of probability that the farmer would rehabilitate himself, were early grounds for dismissal until amendments to the law or court decisions clarified the issues. There is reason to believe that during the first years the number of dismissals was larger than later. In any event, the frequent dismissals may have been a contributing factor in discouraging farmers from seeking benefits of the Act.

Relation to Farm Credit

The problem of relief legislation for farmers is closely connected with agricultural credit. On one hand, large credit institutions have recently maintained that a law such as the Frazier Lemke Act will "dry up credit" while simple moratorium legislation would not have this effect. While the issues are of course more complicated than would appear from this argument, legislation such as the expired Act, does involve a greater recognition of the sharing of the farm risks by lenders. On the other hand, legislation which would include a redemption by the farmer apparently needs to be supplemented by provisions insuring adequate credit from private or public sources. (Project 240. Leader: E. Feder, Agricultural Economics Dept.)

CORRECTION

There was an error in the Spring Quarterly in the "Fly Control on the Farm" article. On page 54, Table 2, chlordane somehow got into the treatment for dairy buildings. Chlordane should not be used in dairy buildings. We are sorry this mistake was printed.

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Faculty